Appendix B
Answers

Answers to Section 2

1. Which mode transitions can the Station-level control software automatically execute?

   The Station-level control software can automatically transition to only two modes: to survival from any mode, and to standard from microgravity mode only.

2. Which type(s) of crew interface computers can be used to manage Caution and Warning?

   The PCS, Control Post Computer (from the attached laptops), Russian laptop, and Robotic Workstation (also from the PCS connected to it).

3. What Caution and Warning indications are received when a fire occurs? If a crewmember is working in Node 1 when the fire occurs, use Figure 2-8 to identify the closest module locations of the C&W indications.

   Caution and Warning indications received include an emergency “repeating beep” tone from the US ATU and the Russian ACU, the fire pushbutton on the C&W panel is backlit red and is appropriately indicated on the Russian C&W Panel, and the PCS displays the fire condition on the C&W Header and other C&W displays. The Russian laptop displays it in a TBD manner.

   There are no ATUs or C&W panels in Node 1. The crewmember should hear the tone from either the Lab ATU (possibly the Airlock ATUs) and/or the FGB ACU. The U.S. Caution and Warning panel lights are available in the lab and airlock. The Russian C&W Panel is accessible from the FGB. Recall that there are also no PCS ports in Node 1. Therefore, crewmembers would have to go one of the crew interface computers capable of managing C&W (identified in question 2). The closest ones would be in the lab, the airlock or the FGB.

4. A crewmember can directly command a Tier 3 MDM.

   b. False - ALL commands must go through Tier 1 and Tier 2 MDMs prior to reaching Tier 3 MDMs.

5. Describe what the following bus names mean: CB CT 4, UB ORB N1 2

   CB CT 4 refers to the control bus (Tier 1 bus) that connects to Communications and Tracking equipment and it is the fourth of multiple buses. UB ORB N1 2 is the User Bus (Tier 3 bus) that connects to orbiter and Node 1 equipment and is the second of multiple buses.

6. If a crewmember sees a sensor reading on a display change, he/she can assume that data on that display from other sensors also reflects a reading taken at the same time?

   b. False - Data is collected at three different rates - the slowest rate is once every 10 seconds. Since the PCS is updated every second, some sensor readings on a display may change while others do not. For 0.1 Hz data, the reading could be up to 10 seconds old. Also, recall that the CVT does not indicate stagnant data. A sensor reading could have been taken, but an intermediate MDM could have failed and the PCS does not receive an accurate sensor reading from the C&C MDMs CVT.

7. What action can be expected from the CDH System if the EXT-1 MDM fails? If LA-3 fails?

   If the Tier 2 MDM EXT-1 fails, the system will power on EXT-2 and automatically switchover to it. If the Tier 3 MDM LA-3 fails, there is no fully redundant MDM so no automatic reconfiguration will take place. Loss of capability associated with that MDM will result.

8. What are the names of the multisegment data buses that exchange information between the SMCCs and the C&C MDMs? Which buses exchange information between the SM Terminal Computers and the U.S. GNC MDMs?

   CB GNC-1 and CB GNC-2 (Russian Bus 7 and Bus 8) exchange data between the SMCCs and the C&C MDMs. LB RS-BUS 1 and LB RS-BUS 2 exchange data between the SM Terminal Computers and the U.S. GNC MDMs.

Answers to Section 3

1. Which of the following functions is **NOT** considered a direct function of the EPS?

   b. DC-to-AC power conversion

2. Which of the following is **incorrect**?

   a. The Sequential Shunt Unit cycles coolant through the array.

3. The function of the Solar Array Wing (SAW) is to: (circle all that apply)

   a. House and protect solar cell blankets during transport.

   c. Deploy and retract solar cell blankets while in orbit.

   d. Collect and convert solar energy into electrical power.

4. Which of the following best describes the ECU?

   b. Firmware controller responsible for deploying/retracting the solar arrays.

5. The DCSU is mounted on the _____.

   a. IEA

6. Which one of the following **BEST** describes the function of the BCDU?

   c. Regulates charging of the batteries.

7. The **primary** function of the DDCUs is to provide health and status information on primary power.

   b. False

8. SPDAs convert primary power to secondary power.

   b. False

9. If a sequential shunt unit is declared lost, which of the following would result?

   a. The power channel would soon cease to function.

10. RPDAs are used in all ISS elements.

    b. False

Answers to Section 3 (continued)

11. The DCSU provides the capability to _____.

    b. Distribute primary and secondary DC electrical power.

12. The range of motion of the beta gimbal is:

    c. 360 degrees

Answers to Section 4

1. Which of the following is NOT a part of a command path of the ISS?

   c. VHF

2. U.S. Segment Video Subsystem receives a video input from the ROS Video Subsystem.

   b. False

3. The S-Band Subsystem has an interface with the

   b. Audio Subsystem.

4. At Flight 8A, if the S-band string fails, which of the following is the MOST direct audio link to the ground?

   b. VHF System

5 U.S. payload experiment data is transmitted to the ground by

   b. Ku-band

6. Which C&T Subsystem multiplexes video and payload data for transmission to the ground?

   b. Ku-band

7. The U.S. subsystem that links the UHF and S-band subsystems is

   c. IAS

8. What C&T Subsystem multiplexes audio and telemetry data for transmission to the ground?

   b. S-band

9. After 6A, recorded systems telemetry normally reaches the ground through which C&T Subsystem?

   a. Ku-band

10. Primary commanding of the U.S. Systems is done through which C&T Subsystem?

    b. S-band

11. The VDS's most important interface for video data is with the

    b. SSRMS

12. C&W tones are sent to the ROS by the IAS.

    b. False

Answers to Section 4 (continued)

13. The CDH OPS LAN receives forward link data from which ISS subsystem.

    a. Ku-band

14. The Russian Segment communication Subsystem that transmits using a high data rate is

    c. Lira

15. What ROS Communication Subsystem cannot directly use the LUCH satellite?

    c. VHF2

16. What ISS Communication System is used to command the Station during orbiter rendezvous?

    c. UHF

17. The IAS distributes audio to the docked orbiter, EVA astronauts and _____.

    c. Russian ACUs

18. Files can be received from the ground by which C&T Subsystem?

    b. Ku-band

Answers to Section 5

1. PTCS Multilayer Insulation (MLI) is analogous to

   c. A home's insulation.

2. Which of the following BEST describes surface coatings used throughout the Station?

   a. Must be resistant to atomic oxygen and radiation.

3. The ITCS is responsible for

   b. Rejecting waste heat from pressurized elements to the EETCS.

4. The ITCS provides which of the following to the IFHX?

   a. Heat collected from internal equipment.

5. The EETCS provides

   c. Temporary cooling for the Station until the ETCS is activated.

6. Which of the following statements if INCORRECT?

   b. The ETCS has two pumps per loop and the EETCS has one.

7. The Interface Heat Exchanger (IFHX)

   b. Is completely external to the module.

8. The temperature of the ammonia in the EETCS loops

   c. Is maintained by bypassing some of the ammonia around the radiators.

9. Which of the following statements BEST describes TCS software

   b. Monitors and controls the system.

10. The FGB ITCS is responsible for

    c. Using both air and water/glycol to provide cooling.

11. The FGB ETCS

    a. Flows through both IFHXs.

Answers to Section 6

1. The Atmosphere Revitalization (AR) Subsystem is primarily responsible for

   c. Removing contaminants from the cabin atmosphere

2. At Flight 8A configuration, the Station's oxygen supply is provided by the oxygen generator in the Russian Segment. Which of the following is NOT available as a backup oxygen supply?

   a. The oxygen generator in the Lab. The USOS does not have an oxygen generator until much later in the assembly sequence.

3. The function of the USOS WRM Subsystem is to

   b. Provide collection, storage, and venting of condensate water

4. Which module contains two Common Cabin Air Assemblies (CCAAs)?

   a. Lab

5. What subsystem's equipment depends on THC air circulation to operate properly?

   a. Fire Detection and Suppression (FDS). Smoke Detectors require air flow to function properly.

Answers to Section 7

1. Briefly describe each of the six functions that U.S./ROS GNC provides to the Space Station.

- Guidance - Tells the Station which route to follow
- State determination - Provides state vector (position and velocity at a specific time)
- Attitude determination - Provides how the Station is oriented
- Pointing and support - Passes state vector, attitude, and attitude rate data to other Station systems; provides mass properties data; calculates target angles for the U.S. solar array alpha and beta joints; calculates Sun and TDRSS line of sight and line-of-sight rate vectors, along with rise and set times; provides GPS time to the C&C MDM to synchronize timing in all MDMs
- Translational control - Provides for desired altitude by performing reboosts/deboosts and also enables the Station to maneuver out of the way of orbital debris
- Attitude control - Provides for control of the Station's attitude using both propulsive and nonpropulsive control

2. For the following Station modes, determine which effector(s) may be used.

   a. CMGs are used for attitude control during microgravity operations, because if thrusters were to be fired , the microgravity environment would be destroyed.

   b. No type of propulsive device would be used in drift mode. CMGs could be kept operational as long as no torques are created on the Station.

   c. For attitude hold, it is possible to use CMGs or SM thrusters, or the combination of CMGs and SM thrusters. The Progress thrusters are also technically available for Station attitude control.

   d. Depending on the amount of fuel available for Progress main engine, it is possible to use Progress main engine or Progress thrusters for debris avoidance. When there is no Progress, the SM main engines may be used to raise the Station altitude.

   e. Nominally, the Progress main engines are used for reboost, with the Progress thrusters as a backup.

3. Summarize the limitations of nonpropulsive attitude control and how these limitations may be overcome.

   a. CMGs become saturated (a point where the external torques in a particular direction exceed the counter capability of the CMGs) and are no longer able to counter the effects of the external torques on the Station. Russian thrusters are fired in a calculated manner to desaturate the CMGs.

Answers to Section 7 (continued)

b. CMGs require a longer period of time to perform maneuvers then thrusters do. A nonpropulsive attitude maneuver requires at least three CMGs for full control capability and two for limited capability.

4. Describe the method used by U.S. GNC software to balance disturbance torques acting on the Station.

   U.S. GNC software balances disturbance torques acting on the Station by repositioning the spin axis of all operational CMGs.

5. Describe (and/or illustrate) the attitude regime that is used to counteract the primary external torques on the Station.

   Orbit average TEA is an attitude where all the torques balance out to zero over the course of an orbit to counteract the external torques acting on the Station (i.e., from Figure 7-3 below).

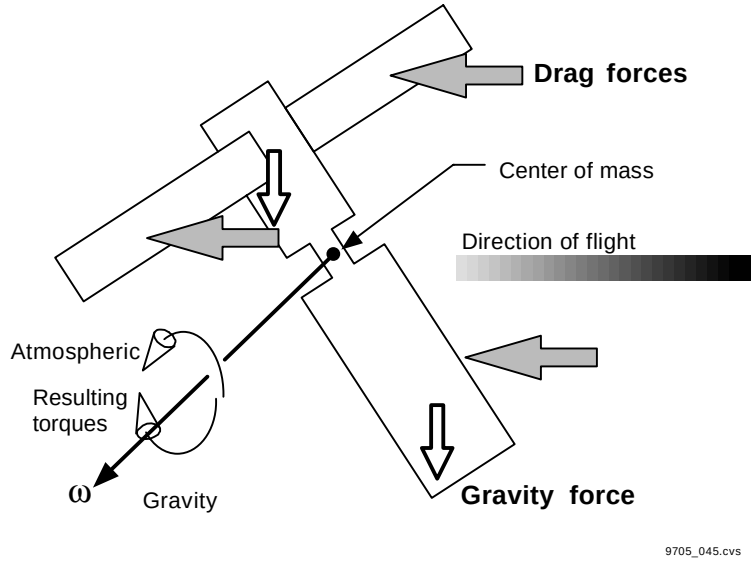

Figure 7-3. Major Station torques

6. Given the following scenarios, state which attitude regime most likely:

   a. XPOP

   b. TEA

   c. XPOP

   d. TEA

   e. XPOP

Answers to Section 7 (continued)

7. Describe the implications for the appropriate systems in each of the following events.

   a. The GNC System loses the capability to communicate with CMG-4, but still has the capability to communicate with three other CMGs.

   b. The capability to exchange the detailed GNC commands and navigation and control data between the U.S. GNC MDMs and RS TCs are lost, if both LB RS-1 and LB RS-2 are lost.

   c. If P&S is degraded, several systems are effected.

   - EPS: Possible power degradation may occur.
   - C&T: Possible high-rate S-band and Ku-band communication lost.
   - Robotics: The changes in mass properties could not be properly tracked, causing attitude control degradation, so the robotics operations may be affected.

   d. Failure of the moderate temperature loop could result in the loss of both GPS R/Ps, one GNC MDM, and one C&C MDM.

   e. Information of the unscheduled venting would be sent to the GNC Flight Controllers, so they can determine the force and torque applied to the Station by this venting, and what course of actions needs to be taken. The venting may cause undesirable Station rotation, which can be counteracted by CMGs or thrusters.

Answers to Section 8

1. Which one of the following ISS types of research includes Fluid Physics?

   c. Microgravity Sciences

2. Which one of the following ISS types of research is primarily concerned with environmental processes?

   c. Earth Sciences

3. Which of the following best characterizes an International Standard Payload Rack (ISPR)?

   b. Basic support structure and outer shell for housing payload hardware *

4. Which of the following best characterizes a Facility Class Payload?

   a. Long-term/permanent Station resident that provides services to a specific type of research

Answers to Section 9

1. Match the Robotics Systems and Subsystems with the correct developing agency.

   __4__ a. Small Fine Arm (SFA)

   __3__ b. Mobile Transporter (MT)

   __2__ c. European Robotic Arm (ERA)

   __1__ d. Space Station Remote Manipulator System (SSRMS)

2. Match the Robotics Systems with the correct prime function.

   __2__ a. European Robotic Arm (ERA)

   __1__ b. Mobile Servicing System (MSS)

   __3__ c. JEM Remote Manipulator System (JEMRMS)

3. Which of the following Robotics Systems does NOT use hand controllers?

   a. European Robotic Arm (ERA)

4. Once the Mobile Transporter (MT) arrives on Flight 8A, the Space Station Remote Manipulator System (SSRMS) can be transported on the MT along the truss.

   b. False

Answers to Section 10

1. Indicate which of the following characteristics correspond to either the EMU or the ORLAN::

_1_	a.	Nominally pressurized to 4.3 psid	1. EMU
_1_	b.	Modular components	2. ORLAN
_2_	c.	After useful life, burns up on re-entry	
_1_	d.	Usually requires a dedicated IV CM to assist in donning	
_1_	e.	Suit parameters displayed on DCM	
_2_	f.	Nominally pressurized to 5.7 psid	

2. False. The Equipment Lock is included in the volume which will nominally be depressed to vacuum so the crew can go EVA.
3. True. The Mini-Workstation (MWS) can be used to provide loose CM restraint.
4. True. The Joint Airlock arrives on Flight 7A.
5. According to the EVA Flight Rules, the basic types of ISS EVAs are:

   b. Scheduled and Contingency*

Answers to Section 11

1. The _____ provide the function of crew and payload translation aids, equipment support and debris shielding.

   b. secondary structures

2. The _____ structurally contain the pressurized atmosphere, which provides the work and living area, and protects the crew from the space environment.

   a. pressurized elements

3. The ____ provide the structural backbone of the Station and attachment points for exposed payloads.

   c. truss assemblies

4. Match the mechanism with its corresponding function.

   __b__ 1. Holds integrated truss to Lab

   __d__ 2. Holds exposed payloads and logistics carriers to the truss

   __a__ 3. Holds modules together on the forward half of Station

   __e__ 4. Mates FGB and PMA 1 together /docks orbiter to Station

   __c__ 5. Holds integrated truss segments together

Answers to Section 12

1. Which of the following is not a subsystem of Crew Systems?

   d. Internal Audio System

2. Which of the following is not a subsystem of Crew Systems?

   c. Water Recovery and Management

3. Which of the following statements is (are) true?

   b. Portable Emergency Provisions are used to sustain the crew in the event of an emergency.

4. Which of the following statements is (are) true?

   a. Restraints and Mobility Aids are used to support crew translation.

5. Which of the following does not interface with the Galley/Food Subsystem?

   c. C&T (Communications and Tracking).

6. Which of the following subsystems interfaces with the on-board Water Systems?

   b. Personal hygiene

7. **Fill in the blank:** The Decals and Placards Subsystem includes items that display location coding information, crew procedures, warning labels, and stowage information.

8. **Fill in the blank:** The Galley and Food Subsystem supports the nutritional needs of the crew.

9. Match the hardware subsystems with their components

1. Restraints and Mobility Aids Subsystem	h. Equipment bag
2. Portable Emergency Provisions Subsystem	d. PBA
3. Housekeeping & Trash Management Subsystem	c. Biocide wipes
4. Lighting Subsystem	e. Task light assembly
5. Operational & Personal Equipment Subsystem	b. Compact disk player
6. Galley and Food Subsystem	a. Meal preparation utensils

Answers to Section 12 (continued)

10. Match the hardware subsystems with their components

1. Stowage Subsystem	b. Stowage tray
2. Decals and Placards Subsystem	h. Warning labels
3. Closeouts Subsystem	a. Rack volume closeout
4. Personal Hygiene Subsystem	f. Waste management
5. Wardroom Subsystem	c. Dining table
6. Inventory Management Subsystem compartment	g. Bar code labels

Answers to Section 13

1. __(In-Situ)_____ Internal water loop repair

2. _(Contingency)__ Module pressure vessel leak repair

3. _(Preventive)____ Scrub module internal walls

4. _(Corrective)____ Remove and replace malfunctioning MDM

5. __(Preventive)__ Module filter cleaning

Notes:

Question 1. The best answer is In-Situ, because one cannot remove the water loop and carry it to another location for repairs. If water is leaking from the loop at a large rate, then the maintenance can also be Contingency, because it requires immediate action. Since the water loop is also being restored to its original condition, the maintenance can also be Corrective.

Question 2. Since the first concern here is crew safety, repairs need to be performed immediately and the maintenance is Contingency, however, the leak also has to repaired at the point where it is leaking, so this can also be considered In-Situ maintenance. Finally, since the vessel wall is being restored to it original condition, the maintenance can be Corrective.

Question 3. Since this is routine repair, is not time critical and the MDM can be moved to another location for repairs, the best answer here is Corrective, because we are restoring MDM functionality to its original condition.

Question 4. Since this must be done at specified, regular intervals, the maintenance being performed is Preventive.

Missing feedback on one question. Will supply later.

Answers to Section 14

1. What is the purpose of the CHeCS?

   b. To ensure the health, safety, well-being, and optimal performance of the ISS crew

2. The purpose of the CHeCS Health Maintenance System (HMS) is to provide

   a. Preventive, diagnostic, and therapeutic care, as well as patient transport capability

3. Which of the following CHeCS components will not be on ISS by Flight 8A?

   b. Incubator

4. The purpose of the CHeCS Countermeasures System (CMS) is to prevent

   c. Cardiovascular and musculoskeletal deconditioning

5. Which of the following CHeCS CMS components will not available by Flight 8A?

   c. Lower Body Negative Pressure (LBNP)

Answers to Section 15

1. What planning product represents the integrated plan to be viewed and executed onboard Station, and contains the specific activities that will be performed by the onboard crew?

   The Onboard Short Term Plan (OSTP)

2. What is the purpose of the Station Operations Data File (SODF)?

   The SODF is the repository of all U.S. Space Station onboard and ground execution procedures. Both crew and controllers will use the SODF to access procedures required to operate the Space Station.

3. During what time period is the Short Term Plan (STP) developed, and how long is the operations period the STP covers?

   The STP is developed the week before operations, and covers one week of operations.

4. What tool will be used by onboard crew and ground controllers to track location and quantity of equipment and supplies onboard ISS?

   The Inventory Management System (IMS).

5. Which of the following provides on-line access via the Internet to operations products and schedules?

   d. Integrated Operations Plan (IOP)

6. Which of the following is not a phase of ISS planning and operations?

   c. Short Term Planning

7. Which collection of software applications is the primary tool used by the Mission Operations Directorate (MOD) to perform Space Station planning and analyses?

   d. Integrated Planning System